

ELEG 3924 – MICROPROCESSOR SYSTEMS DESIGN

Credits and Contact Hours

Three credit hours, 45 hours of instructor contact

Instructor's Name

Randle Overbey

Textbook

- The 8051 Microcontroller and Embedded Systems Using Assembly and C, Mazidi, Mazidi and McKinlay, 2nd Ed., Pearson/Prentice Hall, 2006.

Specific Course Information

- a. Catalog description: Introduction to 8-bit microprocessors and their application. Microprocessor architecture and assembly language; interface devices; system design using microprocessors.
- b. Pre-requisites or co-requisites: Corequisite: Lab component. Pre- or Corequisite: ELEG 2904.
- c. Required.

Specific Goals for the Course

1. Specific outcomes of instructions

After completing this course, students should be able to:

- a) understand basic microcontroller architecture and operation, specifically the architecture and operation of the 8051 microcontroller;
- b) write programs for specific functions, operations and applications for the 8051 microcontroller using both assembly language and C (where applicable);
- c) implement written programs using the Micro Digital Ed 8051 microcontroller trainer, demonstrating proper program operation and the use of the Keil μ Vision 4 interface to program the 8051 microcontroller, and
- d) program and demonstrate the operation of the Keil μ Vision 4 8051 microcontroller simulator to replicate the operation of the 8051 microcontroller and to solve assigned homework problems.

2. Indicate the student outcomes listed in Criterion 3 addressed by the course

- (b) Students demonstrate an **ability to design and conduct experiments as well as analyze and interpret data** through the laboratory experiments interfacing the 8051 microcontroller to the real world. For example, students program the 8051 to generate a square wave and use the oscilloscope to measure the period of the generated square wave and analyze and explain any differences between the observed and programmed square wave periods.

- (c) Students use the 8051 Microcontroller to **design some simple systems** in their laboratory experiments, such as a constructing a digital room temperature display using the 8051 microcontroller, LCD display, analog-to-digital converter and temperature sensor.
- (e) Students are required to **solve engineering problems** related to microcontrollers as they learn to use microcontroller simulation tools to develop programs for a specific purpose and properly interface the 8051 microcontroller to the real world environment.
- (k) Students learn to use the **Keil Microvision 4** integrated development environment as an **engineering tool** to develop, write, simulate, and troubleshoot programs for the 8051 microcontroller; this tool is applicable to other common microcontrollers, which gives the students the ability to easily learn and adapt programming techniques to these other microcontrollers.

List of Topics Covered in Class (class time: 75 min.)

1. Number systems and Logic Gates (2 classes)
2. The 8051 Microcontroller and Basic Assembly Language (4 classes)
3. Jump, Loop and Call Instructions (2 classes)
4. Input/Output Port Programming and Hardware Connections (3 classes)
5. Liquid Crystal Display and Keypad Interface (1 class)
6. Addressing Modes (2 classes)
7. Math and Logic Instructions (2 classes)
8. Timer Programming (2 classes)
9. Serial Port Programming (2 classes)
10. Interrupts (2 classes)
11. Programming in C (2 classes)
12. Memory Interfacing and Motor Control (2 classes)

List of Labs (Lab time: 170 min.)

1. Laboratory 1: Programming Software and Hardware
2. Laboratory 2: Square Wave Generator and Oscilloscope Measurements
3. Laboratory 3: Traffic Light Simulation
4. Laboratory 4: LCD Display Interface
5. Laboratory 5: Analog-to-Digital Converter and Temperature Sensor Interface
6. Laboratory 6: Hexadecimal Keypad Interface